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THE BRYOLOGIST

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SOME STAGES IN THE DEVELOPMENT OF PELLIA EPIPHYLLA.

(CONTINUED)

HELEN E. GREENWOOD.

On May 17 the former collecting ground was returned to. By this time the water of the river had receded several feet and grass and weeds had grown up on the bank to such an extent that it was difficult to find any *Pellia*, where earlier the bank had been covered for several feet with nothing else. The protective covering of the taller plants made the *Pellia* thalli so delicate and tender that they withered almost before they could be put into the fixing solution, which was done as speedily as possible. Since the last collection, the plants showed a considerable increase in size and the antheridial dots were more numerous and more prominent. They were situated all the way from the middle of the thallus nearly to the tip where they were clustered, showing a tendency to slant toward the growing point. On the drier parts of the bank the plants were a pale, yellowish green, reddish purple in the middle. Those in the moister situations were of a much brighter green, of an even color throughout and were more fleshy in structure. Sections through this material showed antheridia that seemed to be fully matured, the several stalk cells and a great number of sperm cells being similar to Fig. 15.

May 24 another locality was visited and *Pellia epiphylla* was found growing with great luxuriance on a moist shaded bank. The same difference in structure and appearance between the plants growing in the drier and moister situations was noted. The microtome sections showed about the same stages of antheridial development as before.

On May 29, the next collecting date, my notes only record the fact that the old brown plants show plainly in contrast to the new green shoots. Sections through this material show earlier stages of the antheridia than in the preceding. This is accounted for by the fact that this was collected from a drier location, while that of May 24 came from a much more moist situation.

The material collected June 7 showed nothing new or different.

Sections made from plants collected on June 14, 1909, showed the same well formed antheridia but material gathered on the same date a year later, June 14, 1910, brought out some interesting comparisons and also for the first time, showed the presence of archegonia. On this latter date two sets of plants were gathered which were growing

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The July Bryologist was issued July 31st.

very close together; one from the bank of a brook flowing with a fairly rapid stream thus keeping the plants always very moist; the other collected a few rods away from a shallow ditch beside the road leading down over this brook. Here the soil to outward appearances seemed dry and the plants were small and in every way apparently much less developed than the more luxuriant ones by the edge of the brook.

Such a difference there proved to be as can be seen from an examination of the accompanying figures. Figs. 25, 26, 27b represent longitudinal sections through the tip of the thallus from plants gathered on the seemingly dry soil of the roadside ditch. Figs. 25 and 30 show the earliest stages of the archegonia, the superficial cells just pushing out beside the growing point. Fig. 16a is the one-celled stage and fig. 16b shows a young archegonium which has divided to form a basal cell and the archegonium mother cell. The presence of the two nuclei indicates that a new cellwall was about to be formed thus dividing the archegonium mother cell into two cells by means of a vertical wall. Fig. 27b is a more advanced stage. Here the involucre which develops as soon as the archegonia appear begins to show and the archegonia are more advanced. In this illustration the central cell is seen to have been differentiated from the outer cells forming the wall of the archegonium. Fig. 28 represents the most advanced specimens of this material; in this the central cell has divided into two parts, an upper one, which by division will form the neck canal cells, and the lower, which will divide into the egg cell and the ventral canal cell. In contrast to this material that gathered by the brookside presented the greatest variety of stages, from the earlier ones (Fig. 18) in which the archegonium mother cell has undergone its first division into two cells, through those in which the central cell has been differentiated from the outer cell (figs. 19 and 20, to fig. 24) showing a full grown archegonium with sixteen canal cells. An average section through this material is shown in Fig. 27a. Here many of the archegonia seem to be fully grown and the protecting envelope above and below has reached its full development. A comparison of these figures is a conclusive proof of the statement made earlier in the paper that plants growing in most situations are much farther advanced at the same season than those of a drier habitat.

On June 20 the original collecting ground was returned to. Here unfavorable conditions due to the receding of the water and a thick growth of weeds and small shrubs had greatly reduced the *Pellia* colony and had apparently made the plants somewhat backward as they showed no advancement over those gathered from another locality on June 14. Sections of this material show exactly the same stages as those figured for that date. The archegonia are of varying stages, but have on the whole more of the later than the earlier ones.

The antheridia appear much the same as on the earlier dates, the antherozoids not having been shed.

Material collected June 25 showed antherozoids still unshed and new antheridia forming near the tip. No archegonia in any stage were found in this material.

June 28 found the plants in much the same condition as before. The archegonia show no special advance and the antherozoids still seem to be unshed. Only the involucres seem to have made any advance in size.

On July 4, the plants collected were very refractory, drying and curling up to such an extent that no really satisfactory sections could be obtained. Antherozoids were still unshed and archegonia seemed to be mature but no signs of a fertilized egg cell could be discovered.

On July 10 the material collected furnished much of interest and a great variety of stages from the one-celled stage of the archegonium to the young embryo, figs. 30a and 31a. One section resembled fig. 27a collected June 10. Another showed that fertilization had already taken place, the egg cell having divided to form a several-celled embryo. A corresponding growth had taken place in the walls of the venter. This new growth had proceeded far enough so that the young embryo under the well developed involucre (which was still lifted up) was visible to the naked eye.

Sections through material gathered July 18, fig. 32 showed the embryos to be much larger, having by this time developed into a many celled, somewhat-pear shaped body. On some plants the involucres were wide open. on others tightly closed. These plants were taken from soil that was saturated with water. As was to be expected from former observations, the plants were of large size and the few that were fruiting were advanced in development. But so large a proportion of the plants were sterile that it was difficult to find enough good material for the fixing solution.

The plants collected on July 26 again showed great diversity of development, some being very immature with unfertilized archegonia, others being sterile, others of an early stage after fertilization (fig. 34), others showing more advanced stages after fertilization (Fig. 33). The most advanced stage found among these sections is represented in Fig. 35. Here the embryo shows some advance over that gathered July 18, for it is larger in every way, and the walls of the venter have increased considerably. A protracted period of dry weather possibly had checked the growth of the plants.

Of the eleven collections made in August only three showed any marked development. Plants collected August 2 showed exactly the same stages as are illustrated in fig. 35. At this season the rhizoids have become so thick and the plants are so closely attached to the soil that more time and patience than ever is needed to clean them

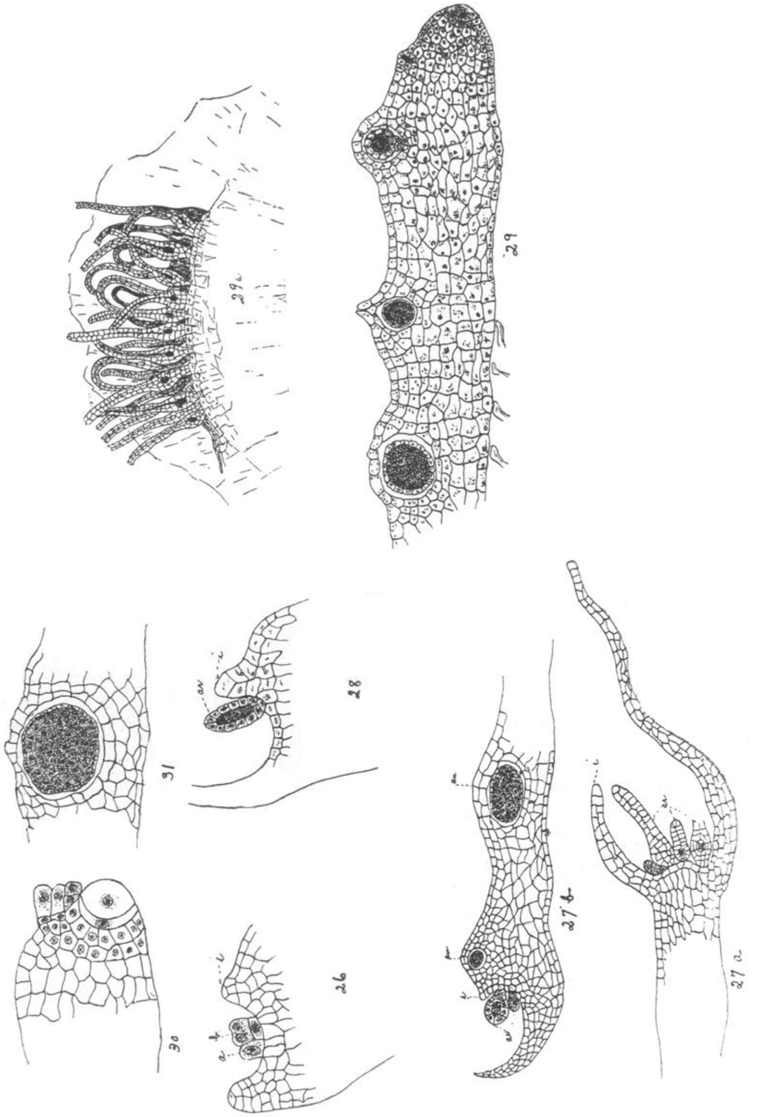

PLATE X

EXPLANATION OF PLATE X.

Fig. 26. Vertical section through tip of thallus × 233. coll. June 14. i—beginning of involucre. a & b—2 early stages of archegonia.

Fig. 27b. Long. section through thallus × 55. Collected on fairly dry soil, June 14.

sufficiently for the fixing solution. The involucres for the most part are tightly closed over the young embryos, but as soon as they are put into the liquid they lift up enough to form a bubble which prevents fixation. This makes very careful trimming necessary for this part of the plant.

Much of the material collected Aug. 6 closely resembled that gathered on Aug. 2 and July 26, shown in fig. 35, but the more advanced stages now show a decided development. Fig. 36 shows that the cells in the young embryo have begun to differentiate into the archesporial cells and around the outside of these are two definite rows of cells which will form the capsule wall. The archesporial cells show plainly for the protoplasm is denser and they take a deeper stain. Development in the walls of the venter now seems to have come to an end.

Some of the sections from material collected Aug. 9 seem to show an increase in the size of the embryo. it being somewhat longer and showing a slight tendency toward a differentiation in shape between the rectangular and more compact cells in the region of the seta and those lower down in the region of the foot, the latter being longer and looser in structure.

Several sections of material collected Aug. 15 indicate that there are two kinds of cells in the archesporial region. those more nearly round or rectangular with large nuclei and which will become spore mother cells and others somewhat elongated which will develop into elaters (fig. 37).

[TO BE CONTINUED]

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i—involucre. ar—archegonia. an—antheridia.

Fig. 27a. Long. section through thallus × 55. Growing on very wet soil June 14. i—involucre. ar—archegonia.

Fig. 28. Another part of long. section through end of thallus represented in fig. 26 × 233.

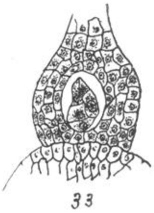
Fig. 29a. Involucre and most of surrounding tissues dissected away to show grouping of archegonia near end of thallus × 40.
Coll. Aug. 17.

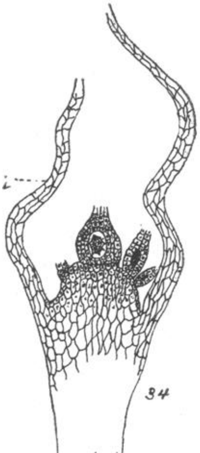
Fig. 29. Median. longitudinal section through growing point of thallus, × 55. coll. Apr. 21. Shows 4 stages of antheridia from immature one nearest tip to one fully developed farthest from tip.

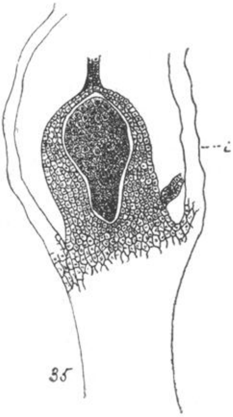
Fig. 30. Median longitudinal section through growing point of thallus × 233. June 14. Same as fig. 25, only more highly magnified.

Fig. 31. Longitudinal section through antheridium in another part of same thallus × 233. June 14.

(Fig. 32 of Miss Greenwood is omitted).







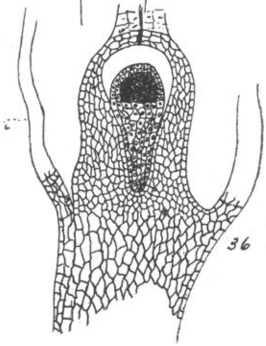


PLATE XI

EXPLANATION OF PLATE XI.

STAGES IN THE DEVELOPMENT OF EMBRYO

Fig. 33. Median long. section of young embryo × 233. July 26. From Fig. 34.

Fig. 34. Median long. section through end of thallus showing old archegonia and one young embryo × 55. July 26.

Fig. 35. Vertical median section through young embryo × 60. July 26. Shows great increase in number of cells in wall of venter. Withered neck of archegonium still persists. Old archegonium left, pushed up on sides of wall of venter.

Fig. 36. Median longitudinal section through young embryo × 55. Aug. 6. Archesporial cells differentiated from those forming capsule wall and seta, venter shows no further growth.

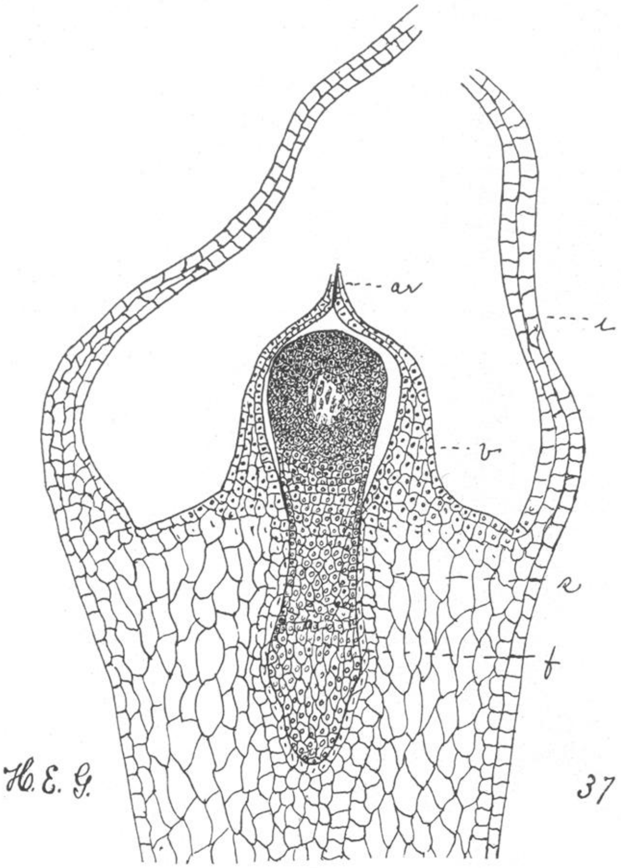


PLATE XII

EXPLANATION OF PLATE XII

Fig. 37. Median longitudinal section through young sporogonium × 110. Coll. Aug. 15. Archesporial cells begin to differentiate into spore mother cells and those which will form elaters.

f—foot.
s—seta.
v—calyptra.
ar—withered neck of old archegonium.
i—involucre.